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Using Early Standardized Language Measures to Predict Later Language and Early Reading Outcomes in Children at High Risk for Language-Learning Impairments

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The aim of the study was to examine the profiles of children with a family history (FH+) of language-learning impairments (LLI) and a control group of children with no reported family history of LLI (FH–) and identify which language constructs (receptive or expressive) and which ages (2 or 3 years) are related to expressive and receptive language abilities, phonological awareness, and reading abilities at ages 5 and 7 years. Participants included 99 children (40 FH+ and 59 FH–) who received a standardized neuropsychological battery at 2, 3, 5, and 7 years of age. As a group, the FH+ children had significantly lower scores on all language measures at 2 and 3 years, on selected language and phonological awareness measures at 5 years, and on phonological awareness and nonword reading at 7 years. Language comprehension at 3 years was the best predictor of later language and early reading for both groups. These results support past work suggesting that children with a positive family history of LLI are at greater risk for future language and reading problems through their preschool and early school-age years. Furthermore, language comprehension in the early years is a strong predictor of future language-learning status.

Keywords: *oral and written language; at risk; early identification*

Much has been written about predicting language-based learning outcomes from language and cognitive function at very early ages. This interest has come from two different directions. First, researchers are interested in understanding how, under normal circumstances, early brain development interacts with the environment to impact language and learning and the etiology of any deviation from the normal trajectory of development. Second, parents, educators, and clinicians are concerned with the identification, remediation, and subsequent development of children at risk for future difficulties. One such risk group is children born into families with a history of language-related difficulties (such as dyslexia and specific language impairment [SLI]). For both researchers and clinicians, it is important that the tools used to diagnose and follow the progress of children's language development reliably measure and characterize language disposition both concurrently and predictively.

Whereas other studies have looked prospectively at children at risk for future language-related problems based on delayed receptive and/or expressive language during the 2nd year of life, we have chosen to follow the language development and early learning development, from infancy through the early school years, of a unique sample of children who are at higher risk for language-learning impairments (LLI) by virtue of their birth into families with at least one first-degree relative with a documented language-based learning disability. Our sample was ascertained at least 6 months prior to the development of oral language, and consequently, the language dispositions of these children were unknown to us when

Authors' Note: We thank all of the families in this study who have spent countless hours in our lab over the years so that we might begin to answer some of the questions of how language and reading are related. Their enthusiasm and dedication to our work have made this article possible.

we began collecting data. The aims of this study were twofold: first, to compare the language profiles of two groups of children from 2 through 7 years old, one group with a family history of LLI (FH+) and a control group with no reported family history of LLI (FH–); and second, to document which of the earlier standardized language measures from ages 2 and 3 years reliably predict expressive and receptive language abilities, phonological awareness, and reading abilities at 5 and 7 years of age.

Receptive and Expressive Language as Early Predictors

There is great variability in the rates of very early language learning, which has been reflected in studies using both observational surveys (Rescorla, 1989) and standardized measures (Fenson et al., 2000; Fenson et al., 1994). Most studies have examined children with some type of delayed language (both receptive and expressive delays or expressive delay only) to determine how early language (at approximately 2 years or younger) relates to early school-age outcomes as well as to academic success into adolescence. Evidence from this large body of literature is mixed and somewhat inconclusive. Some studies suggest that at the very early stages of language development, receptive language is a better indicator of future language abilities (Bates, Bretherton, & Snyder, 1988; Rescorla, 1989; Whitehurst & Fischel, 1994). Other research indicates that delayed expressive language alone may also be an indicator of later language and learning behaviors (Paul, 1996; Rescorla, 2002). Another set of studies suggest that those children with both receptive and expressive language difficulties are most at risk for continued language difficulties (Thal, Jackson-Maldonado, & Acosta, 2000; Thal, O'Hanlon, Clemmons, & Fralin, 1999; Thal, Tobias, & Morrison, 1991).

Once normally developing children reach 3 years of age, the variability that is often observed in the previous years begins to stabilize. Most 3-year-olds have more "adult-like" phonological, syntactic, and morphological systems. At this age, they can produce an extensive array of vowel and consonant sounds and can use simple sentence construction as well as a variety of negative, interrogative, and imperative sentence forms. In addition, they are beginning to develop more advanced phonological skills as well as the use of pronouns, prepositions, and verb endings, making their language more intelligible to people familiar and unfamiliar to them (Owens, 2001). Such skills allow for a better assessment of emerging language through the use of a wider variety of standardized measures, thus possibly making the results of 3-year-old language and cognitive scores more valid predictors of language-based abilities in school-age children.

A large literature demonstrates associations between early and concurrent oral language abilities and reading outcomes. Longitudinal research indicates that children who exhibit difficulties in developing oral language during the early and late preschool years are at increased risk for later language, reading, and general academic difficulties (Aram & Hall, 1989; Bishop & Adams, 1990; Catts, 1993; Catts, Fey, Tomblin, & Zhang, 2002; Scarborough & Dobrich, 1990; Tallal, Allard, Miller, & Curtiss, 1997). In an extensive review of follow-up studies of preschool children with speech and language problems, published between 1965 and 1987, Aram and Hall (1989) reported that anywhere from 40% to 100% of these children continued to have oral language problems during the school-age years and that 50% to 75% reported having reading and other academic difficulties. Scarborough and Dobrich (1990) reported that children who exhibited poor syntactic skills and phonological productions at 30 months of age were later identified as poor readers, whereas Bishop and Adams (1990) found that those children identified at 4 years old with language problems, whose language issues persisted at 5 1/2 years, had poor reading achievement at 8 1/2 years. Catts, Fey, and Proctor-Williams (2000) looked at relations between language and reading in children identified with spoken language impairments and in children with normally developing language and concluded that both phonological awareness and oral language contributed to reading success. Most recently, Wise, Sevcik, Morris, Lovett, and Wolf (2007) reported on the relations among oral language skills and reading skills in a group of 279 reading-disabled second and third graders. The authors found that concurrent receptive and expressive vocabularies were significantly related to prereading abilities and that both expressive vocabulary and listening comprehension were significantly related to single-word reading.

Early language impairments have also been found to affect oral and/or written language abilities throughout the life span so that language and/or academic difficulties can extend through adolescence and well into adulthood. Longitudinal studies demonstrate that even individuals whose early oral language difficulties appear to have resolved are still at higher risk for later deficits in phonological processing, literacy, and general learning difficulties that are language-based in nature (Scarborough & Dobrich, 1990; Snowling, Bishop, & Stothard, 2000). Stothard, Snowling, Bishop, Chipchase, and Kaplan (1998) found that children whose oral language problems had resolved by age 5 performed well as adolescents in the area of language comprehension but continued to manifest problems in phonological processing and literacy skills. Those children who had significant language problems at age 5 continued to have both oral and written language problems as adolescents. In another prospective study, Gallagher, Frith, and Snowling (2000) studied children at risk for future reading problems because of an identified reading problem in a first-degree relative. At 45 months, the "at-risk" children scored worse than their matched controls on measures of receptive and expressive vocabulary, expressive language, nonword repetition, rhyming, digit span, and letter knowledge. By 6 years of age, 57% scored more than one standard deviation below the mean on measures of literacy skills.

Eklund, Lyytinen, and Lyytinen (2005) followed late-talking children who were at risk for dyslexia because of family history ($n = 107$) and a control group of late-talking children with no family history ($n = 93$). Late-talking children who had mixed language delay (receptive and expressive) and a positive family history performed the worst in language of all the children in the study at 5 1/2 years and in reading by the end of the second grade. Interestingly, even those children in the family-history group who did not experience delayed language had significantly lower scores than did their controls in reading and spelling, supporting the importance of family history over and above the influence of early language delay.

There is ample evidence to suggest that children who demonstrate deviations in their early speech and language development run the risk of continued speech and language issues throughout later childhood. In addition, even when language issues have resolved, predictive studies reveal that children with early language delay are at higher risk throughout their lives for related difficulties in phonological awareness, reading, and writing. Children who have a family history of language-based learning disabilities run a similar risk.

Effects of Family History on Language Abilities

LLIs run in families such that children who are born into families with affected family members are at an elevated risk for the disorder (Bishop & Edmundson, 1986; Bishop, North, & Donlan, 1995; Choudhury & Benasich, 2003; DeThorne et al., 2006; Flax et al., 2003; Lahey & Edwards, 1995; Neils & Aram, 1986; Tallal et al., 2001; Tallal, Ross, & Curtiss, 1989; Tomblin & Buckwalter, 1998; Tomblin, 1989; Van Der Lely & Stollwreck, 1996). Studies suggest that the rates of affected individuals in families with a positive history for LLI range from 20% to 80% (Bishop & Edmundson, 1986; Flax et al., 2003; Rice, Haney, & Wexler, 1998; Tallal et al., 2001; Tallal, Ross, & Curtiss, 1989; Tomblin, 1989). In a review of 18 family-aggregation studies of language impairment, Stromswold (1998, 2001) noted that when both reading and language were included in impairment rates, the incidence of affected individuals in families with a history of LLI ranged from 24% (Bishop & Edmundson, 1986) to 78% with a mean incidence of 46%. The incidence of LLI in control families ranged from 3% (Bishop & Edmundson, 1986) to 46% (Tallal, Ross, & Curtiss, 1989) with a mean rate of 18%.

In addition to family aggregation studies, behavioral genetics research has demonstrated that speech and language disorders have a highly heritable component (for reviews, see Leonard, 1998, and Lewis et al., 2006; for a review of the genetics of language and methodology, see Brzustowicz, 1996). Such studies have reported that monozygotic twins show a higher concordance rate (range .70–.96) for language-based learning disorders as compared with dizygotic twins (range .46–.69; Bishop, North, & Donlan, 1995; Lewis & Thompson, 1992; Tomblin & Buckwalter, 1998). Most recently, DeThorne et al. (2006) reported that in a cohort of 248 twin pairs, those children who had histories of speech and language difficulties scored significantly lower than unaffected children on measures of early reading.

Recent studies have also shown that infants born into a family with a positive history for language or reading problems run a greater risk of developing the same kinds of problems themselves (Choudhury & Benasich, 2003; Gallagher, Frith, & Snowling, 2000; Spitz, Tallal, Flax, & Benasich, 1997). In a study of children born into families with a positive family history for LLI, Spitz et al. (1997) found that by 3 years old, as a group, these children scored significantly lower than their matched controls on measures of language but showed no difference in nonverbal skills. In a related family-aggregation study, Choudhury and Benasich (2003) found that 3-year-olds from families with a positive history for SLI scored significantly lower on standardized measures of language and were more likely to fall one or more standard deviations below the mean than a matched control group with no family history of SLI (28% vs. 8%).

Given prior evidence showing that there are robust relations between early language development and later language-based learning outcomes, that the great variability of early language learning stabilizes by age 3, and that the risk of developing language-based learning problems for children born into families with a history of these problems is significant, it seems necessary to examine the following questions: (a) Do children with and without a family history of LLI differ in their language, phonological, and reading abilities at 2, 3, 5, and 7 years of age? (b) What are the associations among early receptive and expressive language abilities and later language, phonological, and early reading skills? (c) Are 2- or 3-year language measures better predictors of language-learning outcomes at 5 and

7 years? To address these questions, we compared the early language abilities of two groups of children (FH+ and FH–) and then examined the associations between early language measures (at 2 and 3 years of age) and later language, phonological awareness, and reading measures (at 5 and 7 years of age) in addition to how well early language predicts performance on 5- and 7-year language and early reading outcomes.

Method

Participants

The data for this study were drawn from a larger, 7-year longitudinal study examining the role of early infant precursors in later language-based learning and cognition. In this study, we report on the outcomes of 2-year-old children, who were recruited as infants from local obstetricians and pediatric practices in northern New Jersey. During the course of the larger study, the children received a comprehensive battery of age-appropriate standardized tasks that included language, cognition, and early reading measures as well as experimental tasks that assessed infant speed of processing, attention, and learning. Here, we report the results from a subset of the standardized assessments that these children received at 2, 3, 5, and 7 years of age.

Forty (40) children (male = 22) reported a positive family history for LLI. To be classified as FH+, families provided us with clinical documentation of LLI for the proband. The term *proband* refers to the individual who meets the behavioral criteria for induction into the study. For all child probands, we required a confirmatory clinical report of an oral or oral and written language impairment (at least one standard deviation below peers on a comprehensive test of oral language) and/or a formal diagnosis from a speech or language pathologist, neurologist, school psychologist, or learning consultant. In the case of parents where no current clinical evaluation was available, a licensed speech or language pathologist made the determination based on a comprehensive personal history that included information on (a) whether the parents were retained a grade in school, (b) whether they were given a diagnosis of dyslexia or a speech or language disorder, and (c) whether they received at least 2 years of language or reading support services. If they responded positively to two out of the three criteria, they were categorized as FH+. Parents who received speech therapy only for articulation or stuttering difficulties were not included.

In this sample, 18% (7/40) of the probands were fathers, 13% (5/40) were mothers, 43% (17/40) were brothers, and 25% (10/40) were sisters. In one case, the subject had no siblings, but the maternal uncle reported severe language and reading problems. Control children (FH–; n = 59, males = 28) reported no known family history of LLI or any other related disorders. The Hollingshead (1975) *Four-Factor Index* revealed no difference in socioeconomic status between the groups (t = .62, p > .05). Furthermore, the number of children who received language-based intervention during their preschool years did not differ between groups (FH+, 8/38 = 21%; FH–, 6/59 = 10%), χ^2 = 2.22, p > .05. The Rutgers University Institutional Review Board approved the study, and appropriate consents were obtained.

Table 1
Standardized Assessments by Age

	Assessment Ages (years)			
	2	3	5	7
PLS-3 Auditory Comprehension, Verbal Expression	X	X	X	
MacArthur CDI Words and Sentences, MLU	X			
TOLD-P3			X	X
Token Test for Children			X	X
PAT Rhyme, Blending, Deletion			X	X
WRM Word Attack, Word Identification, Passage Comprehension				X
Stanford-Binet Intelligence Scale		X	X	X

Note: CDI = *Communicative Development Inventory* (Fenson et al., 1993a, 1993b); MLU = Mean Length of Utterance; PAT = *Phonological Awareness Test* (Robertson & Salter, 1997); PLS-3 = *Preschool Language Scale–3* (Zimmerman, Steiner, & Pond, 1992); *Token Test for Children* (DiSimoni, 1978); TOLD-P3 = *Test of Language Development–Primary, Third Edition* (Newcomer & Hammill, 1997); WRM = *Woodcock Reading Mastery* (Woodcock, 1987).

Measures

A subset of age-appropriate standardized measures of language, phonological awareness, and early reading was selected for this study (Table 1). At each age, the comprehensive oral language measure produced individual receptive (LANG-R) and expressive (LANG-E) language scores that were used to follow language growth over time.

At 2 and 3 years of age, the *Preschool Language Scale–3* (PLS-3; Zimmerman, Steiner, & Pond, 1992) was used to assess receptive (Auditory Comprehension) and expressive (Expressive Communication) language skills. The *Communicative Development Inventory* (CDI; Fenson et al., 1994), a standardized parental report checklist, was also part of the 2-year standardized battery and provided an

Table 2
Intercorrelations of 2-Year Language Measures

	24 CDI W&S	24 CDI MLU	24 PLS-3 Receptive	24 PLS-3 Expressive
24 CDI W&S		0.70**	0.65**	0.74**
24 CDI MLU			0.65**	0.72**
24 PLS-3 Receptive				0.69**
24 PLS-3 Expressive				

Note: r values presented. CDI = *Communicative Development Inventory*; MLU = Mean Length of Utterance; PLS-3 = *Preschool Language Scale–3*; W&S = Words and Sentences.
*$p < .05$. **$p \leq .001$.

expressive language score as well as a Mean Length of Utterance (MLU) score. However, preliminary analyses revealed significant intercorrelations among all four language measures in both groups at 2 years (PLS–Auditory Comprehension, PLS–Expressive Communication, and CDI–Words and Sentences and MLU; Table 2). Because the correlations between the PLS–Expressive Communication and the CDI–Words and Sentences and MLU were so strong ($r = .74$ and $r = .72$, respectively), we opted to include only one measure of expressive language at 2 years of age for all subsequent analyses. Therefore, the correlation and regression analyses we present are restricted to the PLS–Auditory Comprehension and PLS–Expressive Communication as they were the most comprehensive of the language measures at 2 years of age.

At 5 and 7 years of age, the majority of participants (n = 66) received the *Test of Language Development–Primary, Third Edition* (TOLD-P3; Newcomer & Hammill, 1997). Receptive language ability was derived from the Listening cluster of subtests, and expressive language ability was derived from the Speaking cluster. A small group of children received only the PLS-3. However, a subgroup of 16 children (8 = FH+ and 8 = FH–) received both the PLS-3 and the TOLD-P3, thus allowing us to assess differences associated with the demand characteristics of each test and the reliability of using either measure at 5 years to assess receptive and expressive language scores. A within-subjects analysis revealed no significant difference based on the measures, $F(1, 15) = 0.07$, $p = .80$, and the scores from both the assessments were significantly correlated ($r = .59$, $p < .05$). Therefore, the PLS-3 scores were used for receptive and expressive language at 5 years for those children who received only the PLS-3, whereas all other receptive and expressive language scores at 5 years were derived from the TOLD-P3.

At 5 and 7 years of age, the *Token Test* (DiSimoni, 1978), a measure that taps verbal memory and the ability to follow directions of increasing length and grammatical complexity, was included as an auxiliary test of receptive language. It has been a reliable measure in the past (Flax et al., 2003; Tallal et al., 2001) for capturing characteristics of receptive language (i.e., following increasingly longer and grammatically complex directions) that are not directly assessed in the language battery but are an important component of language in the school setting.

In addition, three subtests that measure phonological awareness were introduced from the *Phonological Awareness Test* (Robertson & Salter, 1997): Rhyming, Deletion, and Blending of words.

At 7 years of age, three subtests of the *Woodcock Reading Mastery Tests–Revised* (Woodcock, 1987) were administered to assess early reading abilities: Word Identification, a measure of single-word reading; Word Attack, a measure of nonword reading; and Passage Comprehension, a measure of listening comprehension.

In addition to the language measures, each child received *The Stanford-Binet Intelligence Scale–Fourth Edition* (Thorndike, Hagen, & Sattler, 1986) at 3, 5, and 7 years of age to assess general cognitive ability. The Abstract Visual Reasoning cluster was used as a measure of nonverbal IQ. A repeated measures analysis of variance (ANOVA) was performed to determine whether the two groups differed on overall cognitive ability and specifically on nonverbal ability. Results indicated that the groups did not differ on overall cognitive ability—36 months, $F(1, 82) = 3.8$, $p = .06$; 60 months, $F(1, 73) = 3.4$, $p = .07$; and 84 months, $F(1, 59) = 0.34$, $p = .57$)—or on specifically nonverbal abilities—36 months, $F(1, 82) = 1.2$, $p = .28$; 60 months, $F(1, 73) = 1.97$, $p = .16$; and 84 months, $F(1, 59) = 0.86$, $p = .36$.

Statistical Analyses

Initial analyses included a univariate analysis procedure performed on each of the variables to obtain descriptive statistics. Group differences in receptive and expressive language were evaluated using an ANOVA. Pearson product–moment correlations were performed to examine associations among early language measures

Table 3
Mean Standardized Language, Phonological Awareness, and Early Reading Scores by Family History

	FH+		FH–				
	M	*SD*	*M*	*SD*	*F*	*p*	Cohen's *d*
2 years							
PLS-3 Receptive Language	**91.20**	**14.59**	**105.08**	**17.04**	**15.53**	**.000**	**.89**
PLS-3 Expressive Language	**95.09**	**14.68**	**104.35**	**14.01**	**8.79**	**.004**	**.64**
CDI Words and Sentences	**36.16**	**28.51**	**49.93**	**30.38**	**4.81**	**.031**	**.44**
CDI MLU	**1.78**	**0.49**	**2.14**	**0.41**	**14.85**	**.000**	**.79**
3 years							
PLS-3 Receptive	**100.72**	**20.62**	**111.33**	**17.00**	**7.09**	**.009**	**.59**
PLS-3 Expressive	**94.75**	**15.76**	**107.31**	**16.77**	**12.71**	**.001**	**.83**
Nonverbal IQ	104.42	11.74	107.38	12.27	1.17	*ns*	.26
5 years							
*Receptive Language Score	**105.49**	**21.04**	**113.78**	**13.22**	**4.36**	**.04**	**.10**
*Expressive language score	102.74	19.02	109.43	12.31	3.34	*ns*	.44
Token Test total	**96.71**	**14.60**	**102.78**	**9.42**	**3.89**	**.05**	**.50**
PAT Rhyming	**103.16**	**13.92**	**111.77**	**9.65**	**8.35**	**.005**	**.71**
PAT Blending	94.04	13.03	100.27	11.50	1.82	*ns*	.49
PAT Deletion	102.00	10.05	101.47	9.39	0.04	*ns*	–.10
Nonverbal IQ	101.79	13.57	105.95	11.95	1.97	*ns*	.33
7 years							
TOLD-P3 Receptive (Listening)	106.00	11.59	110.41	9.86	2.58	*ns*	.39
TOLD-P3 Expressive (Speaking)	103.56	12.97	105.74	11.35	.49	*ns*	.17
Token Test total	**99.41**	**14.76**	**105.94**	**7.25**	**5.12**	**.027**	**.54**
PAT Rhyming	**101.93**	**12.77**	**106.74**	**4.44**	**4.20**	**.045**	**.55**
PAT Blending	91.89	16.02	96.26	13.07	1.38	*ns*	.34
PAT Deletion	100.41	13.60	103.06	10.80	0.721	*ns*	.25
WRM Word Attack	**101.46**	**10.89**	**107.44**	**10.88**	**4.44**	**.039**	**.60**
WRM Word Identification	108.00	15.18	113.53	15.17	1.96	*ns*	.33
WRM Passage Comprehension	104.35	15.31	110.62	12.17	3.12	*ns*	.44
Nonverbal ability	96.96	19.23	100.71	12.22	0.86	*ns*	.25

Note: CDI = *Communicative Development Inventory*; MLU = Mean Length of Utterance; FH+ = family history of language-learning impairments; FH– = no reported family history of language-learning impairments; PAT = *Phonological Awareness Test*; PLS-3 = *Preschool Language Scale–3*; TOLD-P3 = *Test of Language Development–Primary, Third Edition*; WRM = *Woodcock Reading Mastery*.

at 2 and 3 years of age and all outcome measures at 5 and 7 years of age for both groups. Finally, these data were used to guide a series of hierarchical regressions that were performed to determine the predictability of early language measures to 5- and 7-year outcome variables of language, phonological awareness, and early reading. t tests revealed no sex differences on the standardized measures reported in this study except for the 5-year blending score, $t(1, 59) = 2.09$, $p = .04$.

Results

Comparison of Standardized Scores by Family History

At 2 and 3 years, the FH+ and FH– groups significantly differed on all language measures. The FH+ group consistently scored lower in both receptive and expressive language. At 5 years, composite receptive language scores as well as the *Token Test* and rhyming continued to reveal differences between the groups. At 7 years, the *Token Test*, rhyming, and nonword reading differed between the two groups (Table 3).

Associations Among Language, Phonological Awareness, and Early Reading Measures

Because the FH+ and FH– groups differed on a number of measures, correlation analyses were run separately by group (FH+ and FH–) to examine within-group patterns of associations. Overall, a number of significant associations were seen between early (2 and 3 year) and later (5 and 7 year) language measures, with the number of associations for receptive language being greater than that for expressive

Table 4
Correlations of 2- and 3-Year Language Measures to 5-Year and 7-Year Outcome Measures by Family History

	FH+				FH–			
	2-Year LANG-R	2-Year LANG-E	3-Year LANG-R	3-Year LANG-E	2-Year LANG -R	2-Year LANG-E	3-Year LANG-R	3-Year LANG-E
5-Year LANG-R	0.46*	0.56**	0.77**	0.73**				
5-Year LANG-E	0.59*	0.68**	0.78**	0.71**	0.45 **		0.43*	0.49*
5-Year TOKEN			0.78**	0.66**			0.58**	0.39*
5-Year RHYME			0.53*	0.53*	0.37*		0.38*	
5-Year DEL	0.46*							
5-Year BLEND	0.46*		0.42*		0.42*		0.49**	
7-Year LANG-R								
7-Year LANG-E			0.42*					
7-Year TOKEN			0.61**	0.51**			0.35*	0.39*
7-Year RHYME								
7-Year DEL	0.51*		0.44*				0.44*	
7-Year BLEND								
7-Year PC							0.56**	
7-Year WA							0.46*	
7-Year WID							0.60**	

Note: *r* values presented. BLEND = *Phonological Awareness Test–Blending*; DEL = *Phonological Awareness Test–Deletion*; FH+ = family history of language-learning impairments; FH– = no reported family history of language-learning impairments; LANG-E = expressive language ability; LANG-R = receptive language ability; PC = *Woodcock Reading Mastery–Passage Comprehension*; RHYME = *Phonological Awareness Test–Rhyming*; TOKEN = *Token Test*; WA = *Woodcock Reading Mastery–Word Attack*; WID = *Woodcock Reading Mastery–Word Identification*.
*$p < .05$. **$p \le .001$.

language and with the majority of these associations being stronger in magnitude for the FH+ group. Furthermore, 3-year measures were more strongly associated with 5- and 7-year language outcomes than were the 2-year measures. The following sections summarize the data by group (Table 4).

FH+

Significant associations were found between 2-year language measures and 5-year outcome measures: 2-year receptive language was associated with 5-year receptive language ($r = .46$, $p < .05$), expressive language ($r = .59$, $p < .05$), the deletion task ($r = .46$, $p < .05$), and sound blending ($r = .46$, $p < .05$); and 2-year expressive language was related to 5-year receptive ($r = .56$, $p < .001$) and expressive language ($r = .68$, $p < .001$). For example, children who demonstrated weaker receptive and expressive language skills at 2 years of age had lower standard scores on 5-year receptive and expressive language, deletion, and blending. At 7 years, only 2-year receptive language was found to be associated with the 7-year deletion task ($r = .51$, $p < .05$).

A greater number and more significant associations were found between 3-year language measures and 5-year outcome measures: 3-year receptive language was strongly associated with 5-year receptive language ($r = .77$, $p < .001$), expressive language ($r = .78$, $p < .001$), the *Token Test* ($r = .78$, $p < .001$), rhyming ($r = .53$, $p < .05$), and blending ($r = .42$, $p < .05$); and 3-year expressive language was significantly related to 5-year receptive language ($r = .73$, $p < .001$), expressive language ($r = .71$, $p < .001$), the *Token Test* ($r = .66$, $p < .001$), and rhyming abilities ($r = .53$, $p < .05$). Thus, children who scored more poorly on receptive and expressive language skills at age 3 demonstrated lower standard scores on 5-year language and phonological abilities. At 7 years of age, 3-year receptive language was associated with 7-year expressive language ($r = .42$, $p < .05$), the *Token Test* ($r = .61$, $p < .001$), and the deletion task ($r = .44$, $p < .05$). Finally, 3-year expressive language was associated only with 7-year *Token* scores ($r = .51$, $p < .05$).

FH–

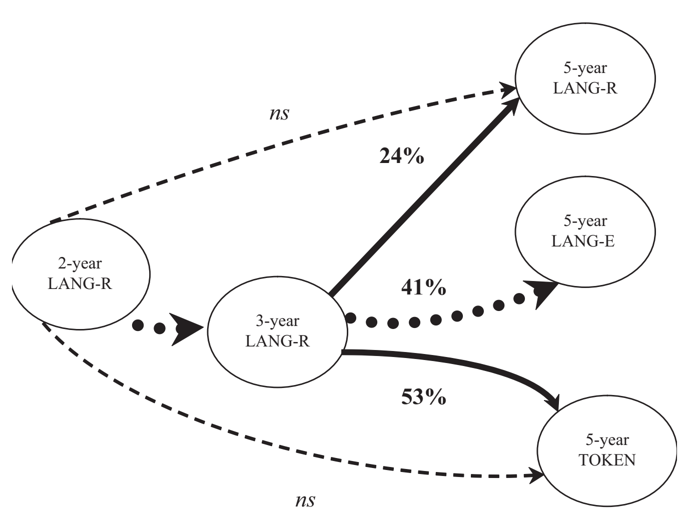
Similarly, significant associations were shown between 2-year receptive language measures and 5-year outcomes, including expressive language ($r = .45$, $p < .001$), rhyming ($r = .37$, $p < .05$), and blending ($r = .42$, $p < .05$). Children who demonstrated weaker receptive language skills at age 2 achieved lower standard scores on 5-year expressive language, rhyming, and blending.

However, 2-year expressive language was not found to be associated with any of the 5- or 7-year measures.

At 3 years of age, receptive language was related to 5-year expressive language ($r = .43$, $p < .05$), the *Token Test* ($r = .58$, $p < .001$), rhyming ($r = .38$, $p < .05$), and the blending task ($r = .49$, $p < .001$). Expressive language at 3 years was associated with 5-year expressive language ($r = .49$, $p < .05$) and with the *Token Test* ($r = .39$, $p < .05$). Therefore, children who demonstrated weaker language skills at 3 years of age demonstrated lower language abilities at 5 years.

Similar patterns emerged among 3-year and 7-year language measures: 3-year receptive language was significantly associated with the *Token Test* ($r = .35$, $p < .05$), the deletion task ($r = .44$, $p < .05$), and all three reading measures (Passage Comprehension, $r = .56$, $p < .001$; Word Attack, $r = .46$, $p < .05$; and Word Identification, $r = .60$, $p < .001$).

Figure 1
Hierarchical Regression Analysis for Language Measures at 2 and 3 Years Predicting to 5-Year Language Outcome Measures



Note: LANG-E = expressive language ability; LANG-R = receptive language ability; TOKEN = *Token Test*.

Predictability of Early Language (2 and 3 Years) Measures to 5- and 7-Year Outcome Measures

A series of hierarchical regression analyses were computed using early variables that were significantly correlated with later outcome variables. This was done to determine whether measures of language at 2 or 3 years were stronger predictors of later language and early reading outcomes. FH was entered into two of the nine regression models (7-year *Token* and 7-year Word Attack) because correlations showed that FH was related to these variables. In each model, 2-year receptive language (2-year LANG-R) and 3-year receptive language (3-year LANG-R) ability were entered as predictors of 5- and 7-year receptive and expressive language skills and the *Token Test*, as well as 7-year reading ability (Passage Comprehension, Word Attack, Word Identification). In all models, receptive, rather than expressive, language was used as a predictor because the two measures were significantly correlated at both ages (2 years, $r = .68$; 3 years, $r = .81$). Moreover, research has shown that receptive language is a more robust and reliable predictor of later language and reading outcomes as compared with expressive abilities (Catts, Adlorf, & Weismer, 2006). Although the *Token Test* is primarily a test of receptive language, it also taps into other skills necessary for language and learning success, such as short-term memory, basic concept vocabulary, and multitask performance.

Predicting 5-Year Language Abilities

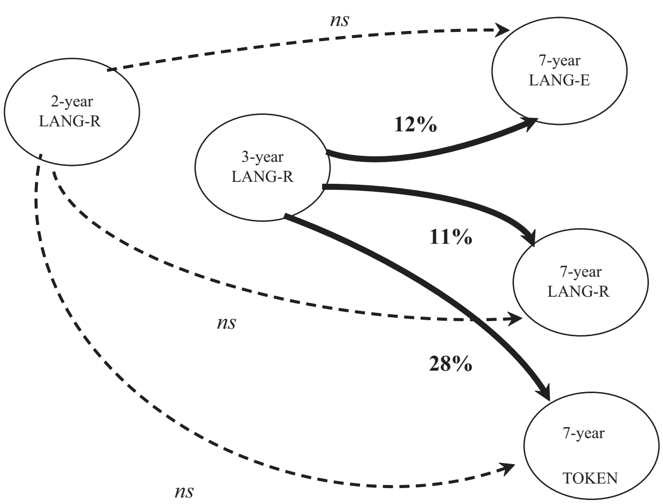
Regression analyses predicting 5-year receptive language skills revealed that when 2- and 3-year receptive language abilities were entered into the model, only 3-year receptive language significantly predicted language at 5 years, accounting for 24% of the variance ($R^2_{adj} = 0.24$, $p < .001$). A similar pattern emerged for the *Token Test* where 3-year receptive language predicted 53% of the variance.

Regression analyses predicting 5-year expressive language skills revealed that when 2-year receptive language ability was entered into the model alone, it predicted 18% of the variance at 5 years ($ß = 0.27$, $R^2_{adj} = 0.18$, $p = .001$). However, when 3-year receptive language ability was added to the model, the association between 2- and 5-year language ability was fully mediated by 3-year receptive abilities—that is, 3-year receptive language significantly predicted 41% of the variance in performance on 5-year measures (see Table 5 and Figure 1).

Predicting 7-Year Language and Reading Abilities

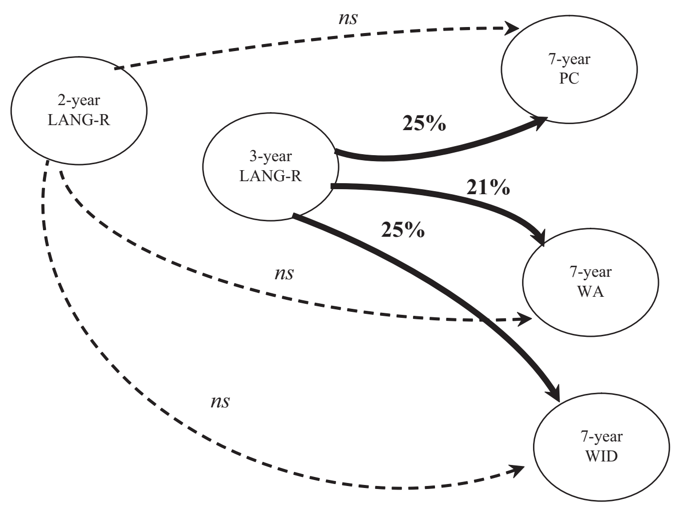
Our results revealed a similar pattern of predictions for 7-year language (Table 6 and Figure 2) and reading abilities (Table 7 and Figure 3). In all models, only 3-year receptive language ability entered significantly, accounting for 11% of the variance for receptive language, 12% of the variance for expressive language, 28% of the variance in performance on the *Token Test*, 25% of the variance in Passage

Figure 2
Hierarchical Regression Analysis for Language Measures at 2 and 3 Years Predicting to 7-Year Language Outcome Measures



Note: LANG-E = expressive language ability; LANG-R = receptive language ability; TOKEN = *Token Test*.

Figure 3
Hierarchical Regression Analysis for Language Measures at 2 and 3 Years Predicting to 7-Year Reading Outcome Measures



Note: LANG-E = expressive language ability; LANG-R = receptive language ability; PC = *Woodcock Reading Mastery–Passage Comprehension*; WA = *Woodcock Reading Mastery–Word Attack*; WID = *Woodcock Reading Mastery–Word Identification*.

Table 5
Hierarchical Regression Analysis for Language Measures at 2 and 3 Years Predicting to 5-Year Language Outcome Measures

Outcome Predictor	*B*	*SE* *B*	ß	Model ΔR^2_{adj}
5-year receptive language				.24**
Step 1: 2-year LANG-R	.10	.12	.12	
Step 2: 3-year LANG-R	.40	.12	.43**	
5-year expressive language				.41**
Step 1: 2-year LANG-R	.22	.09	.27*	
Step 2: 3-year LANG-R	.39	.09	.49**	
5-year *Token Test*				.53**
Step 1: 2-year LANG-R	.04	.08	.06	
Step 2: 3-year LANG-R	.54	.08	.70**	

Note: LANG-R = receptive language ability.
*$p \leq .05$. **$p \leq .001$.

Table 6
Hierarchical Regression Analysis for Language Measures at 2 and 3 Years Predicting to 7-Year Language Outcome Measures

Outcome Predictor	*B*	*SE* *B*	ß	Model R^2_{adj}
7-year expressive language				.12*
Step 1: 2-year LANG-R	.04	.12	.07	
Step 2: 3-year LANG-R	.23	.12	.30*	
7-year receptive language				.11*
Step 1: 2-year LANG-R	.04	.10	.05	
Step 2: 3-year LANG-R	.21	.10	.31*	
7-year *Token Test*				.28**
Step 1: 2-year LANG-R	.05	.10	.07	
Step 2: 3-year LANG-R	.37	.11	.49**	

Note: LANG-R = receptive language ability.
*$p \leq .05$. **$p \leq .001$.

Comprehension, 21% of the variance in Word Attack, and 25% of the variance in Word Identification. FH did not remain as a significant predictor when other early language variables were entered and, as such, did not account for any of the variance above and beyond those measures.

Clinical Categorization

Given that the children in the FH+ group could potentially present with different types and varying degrees of language-related strengths and weaknesses depending on age and level of language development, we also examined the incidence of "low language" scores in language-related domains at each age that we tested. We defined *low language* as a standard score of ≤85 (M = 100, SD = 15) in any of the individual language-learning domains assessed. At 2 and 3 years, this included both receptive and expressive language; at 5 years, we added

Table 7
Hierarchical Regression Analysis for Language Measures at 2 and 3 Years Predicting to 7-Year Reading Outcome Measures

Outcome Predictor	*B*	*SE* *B*	*ß*	Model R^2_{adj}
7-year PC				.25**
Step 1: 2-year LANG-R	.06	.11	.08	
Step 2: 3-year LANG-R	.39	.12	.46*	
7-year WA				.21*
Step 1: 2-year LANG-R	–.08	.09	–.12	
Step 2: 3-year LANG-R	.35	.10	.50**	
7-year WID				.25**
Step 1: 2-year LANG-R	–.01	.12	–.02	
Step 2: 3-year LANG-R	.48	.13	.51**	

Note: LANG-R = receptive language ability.
*$p \leq .05$. **$p \leq .001$.

the *Token Test* and the three phonological awareness measures (rhyming, deletion, and blending); and at 7 years, three reading measures (Word Attack, Word Identification, and Passage Comprehension) were included. At the 2-year assessment, almost half the children (48.6%) from the FH+ group demonstrated low language either in receptive or expressive language or in both domains. At age 3, that rate was 27.8%, and at age 5, 31.4% of the FH+ group presented with low receptive or expressive language or a low score on the *Token Test*. In addition, 32.1% of children in the FH+ group demonstrated difficulty with one or more of the phonological awareness tasks. At the 7-year assessment, the rate of low language in at least one language domain was 18.5%, the rate of low scores in one or more of the phonological awareness domains was 37%, and the rate of low reading skills in at least one domain was 15.4%. Rates of low language in the FH– group at any given age were negligible and ranged from 0% to 10% on all standardized assessment at all ages.

Discussion

The FH+ and FH– groups differed on all standardized language measures at 2, 3, and 5 years of age. At 7 years of age, composite language scores did not differentiate the groups, but the *Token Test*, as well as phonological awareness (rhyming) and nonword reading measures, differed by group, with the FH+ samples having significantly poorer scores. At all ages, nonverbal IQ did not significantly differ between groups. In addition, multiple significant associations emerged between the 2- and 3-year language measures and the 5- and 7-year language, phonological awareness, and early reading measures with most associations stronger for the FH+ group. Overall, the patterns of results suggest that 3-year receptive language is the better predictor of later language and early reading outcomes.

Standardized Language Measures That Differentiate the Two Groups

Even though, as a group, the FH+ children performed in the average to low-average range on many of the measures administered, for the majority of measures, mean FH+ group scores fell significantly below the scores of the FH– group. This finding captures the variability within the FH+ group that is a function of a mixed distribution. Whereas a subset of FH+ children were performing significantly more poorly than the group mean, the balance of the group performed comparably to the FH controls. Thus, we see group scores for the FH+ group that significantly differ from controls but remain within the average to low-average range. Given that the FH+ sample is at higher risk by virtue of family history but is not a clinically ascertained sample, such a mixed distribution is exactly what would be expected. In past family-history studies where rates of impairment were determined based on the numbers of family members who were "affected," the rates of LLI have ranged from approximately 20% to 80% (Bishop & Edmundson, 1986; Flax et al., 2003; Rice, Haney, & Wexler, 1998; Tallal et al., 2001; Tallal, Ross, & Curtiss, 1989; Tomblin, 1989), depending on the criteria used for LLI. The children in the present study were ascertained at 6 months of age, prior to oral language onset, and yet, at each age, a subset of these children fell significantly below their matched controls in language, phonological awareness, and/or early reading abilities. However, the percentage of children in this "high-risk" group who will ultimately go on to be clinically diagnosed with an LLI at some point in their lives is not yet known.

It is clear that the potential for difficulties in the language domain is not restricted to the early language-learning years. Profiles of children at risk for LLI can and do change across development (Conti-Ramsden & Botting, 1999), emphasizing the ongoing need for vigilance and repeated assessment. Our analyses revealed that language comprehension at 3 years of age was a strong predictor of later language. The relations between language comprehension and reading comprehension have been examined in the past (Bishop & Adams, 1990) and are being reexamined in light of the current emphasis on language and reading relations. This current area of research suggests that children who have ongoing language comprehension issues or early difficulties in language comprehension may be the same children who have difficulties with reading comprehension even when age-appropriate, single-word reading has been achieved (Catts, Adlorf, & Weismer, 2006; Nation, Clarke, Marshall, & Durand, 2004; Nation & Snowling, 1998). Catts et al. (2006) found that a group of eighth-grade children with problems in reading comprehension also had difficulty with oral language comprehension either concurrently or previously. The children in the present study are still in the early stages of reading acquisition, and it is too early to determine future reading comprehension. However, some children have already shown evidence of poorer language comprehension as reflected by their significantly lower scores in language comprehension measures at every age.

Most of the emphasis in reading acquisition has been placed on the role of phonological awareness in the development of decoding skills (Wagner & Torgesen, 1987); however, the influence of oral language comprehension as either an aid or a deterrent to reading is equally important. In our sample, the rhyming task was the only phonological awareness task that differentiated the groups, yet our strongest associations with reading were based on receptive language. Catts, Fey, and Proctor-Williams (2000) reported on the reading outcomes of children in second and fourth grades with and without language impairments. They determined that in the early stages of reading, both phonological awareness and oral language contributed to reading outcomes, but oral language abilities played even an even stronger role in reading success as the children got older. In a study of concurrent associations between oral language abilities and reading in a group of reading-impaired second and third graders, Wise et al. (2007) found that expressive vocabulary as well as listening comprehension were significantly associated with single-word reading abilities. Their expressive vocabulary task was derived from the WISC-III (Wechsler, 1991), which required the subject to define words rather than to name them, resulting in a high-order linguistic and metalinguistic task. Although their task was concurrent and our tasks are predictive, both emphasize the importance of oral language in the reading process, whether or not there is a deficit in decoding skills.

The outcomes reported here are strikingly similar to those described by Stothard et al. (1998), Paul (1996), and Rescorla (2000, 2002). However, it is important to note that the samples in those studies were *specifically selected* for early language delay, whereas our family-risk sample was identified early in infancy, well before the development of expressive language. By ages 6, 7, and 8, Rescorla's early-language-delay group differed from the control group on measures of vocabulary (ages 6, 7, and 8), grammar (ages 6 and 8), and phonology (age 6). Rescorla noted, as we do here, that the group mean scores fell within the average range but were consistently lower than their matched controls.

Although the two groups in the present study did not specifically differ on comprehensive language measures at 7 years of age (TOLD-P3), the *Token Test* continued to discriminate between the two groups. Because the objective of the *Token Test* is to follow oral directions of increasing length and grammatical complexity, the task is similar to the types of receptive language demands required of a child in the elementary school environment and, therefore, may be considered a very practical assessment of language comprehension during the school-age years. The *Token Test* has proved to be a reliable phenotypic measure of language ability in previous studies when used as an independent measure of receptive language alone or in conjunction with other language measures (Flax et al., 2003; Tallal et al., 2001; Tomblin, Freese, & Records, 1992). Finally, the Word Attack subtest, a nonword reading and decoding skill, was the only reading measure that differentiated the groups at 7 years. The majority of our 7-year-olds were in first grade, which is the time when decoding abilities are being introduced and thus creating new challenges for those children who are at high risk for LLI.

Associations and Predictions of Early Measures (2 and 3 Years) and Later Measures (5 and 7 Years)

Although multiple significant associations were seen between earlier (2 and 3 years) and later measures (5 and 7 years) in this sample, there were more associations seen at age 3 than at 2 years of age, and those associations were stronger. It may well be the case that the variability in language production, as well as the extreme variability in temperament, seen at 2 years of age leads to less reliable test results for 2-year-olds and thus poorer predictive ability. Well-controlled laboratory testing of prelinguistic auditory abilities in infants has produced impressively reliable results regarding predictability from early perceptual abilities to later language (Benasich & Tallal, 2002; Choudhury & Benasich, 2003). Yet the use of standardized instruments alone at later ages, specifically at 2 years of age, may not be as reliable for predicting later language. In fact, the substantial degree of variability found in 2-year measures of language is addressed in two articles concerning the MacArthur CDI. Feldman et al. (2000) suggested that the CDI might not be a reliable tool for assessing concurrent expressive language status, for making a clinical diagnosis, or for evaluating children at risk for future language difficulties given the very large standard deviations and differences in mean scores as a function of socioeconomic status. Fenson et al. (2000) argued that this variability was not an outcome of the standardization methods for the CDI but rather was a reflection of the natural degree of variability that is seen in 2-year-olds. In our FH– control group, there were no significant associations between 2-year expressive language measures and any of the 5- or 7-year measures. This finding further reflects the natural variability seen in expressive language during this period of development. For the same reasons, we suggest that at 3 years of age, both clinicians and researchers can obtain a fairly accurate assessment of current language status that can be used to predict future language-related abilities.

Because receptive language at 3 years was the strongest predictor of later language abilities, we were interested in finding out which areas of spoken language might be most effected by receptive language at 3 years in our FH+ group. Strongest associations were found between 3-year receptive language scores and the Sentence Imitation task of the TOLD (very much a syntactic task) at 5 and 7 years ($r = .69$, $p = .000$ and $r = .71$, $p = .000$, respectively). When cluster scores of the TOLD were examined, the strongest associations were between 3-year receptive language and the syntax cluster at both 5 and 7 years ($r = .68$, $p = .000$ and $r = .65$, $p = .000$, respectively). One must be mindful of the oral and written language deficits that might persist beyond phonology. There is a trend to focus on phonological awareness as children learn to read; however, children with a family history of language disorders might have more pervasive problems in the areas of morphology and syntax, which should not be ignored.

The fact that more associations were seen between early receptive language and later measures (in contrast to early expressive language) also strongly suggests that receptive language abilities may be better indicators of concurrent and future abilities. Studies that have examined longer term outcomes of children with receptive and/or expressive language delay report that the children showing early receptive language or mixed receptive-expressive delays are the same children who are more likely to continue to have language-learning problems. Many of the children diagnosed with only expressive delays showed fewer problems or had been able to resolve most of those problems by the time they enter school (Whitehurst & Fischel, 1994; Whitehurst, Fischel, Arnold, & Lonigan, 1992).

Clinical Application

Studies that address the clinical management of language delay in very young children have focused on children who are late talkers with early expressive language delay. Several approaches have been adopted including monitoring of language (the "watch and see" approach), parent training for language stimulation, or traditional intervention with a speech or language professional (Paul, 1996; Whitehurst, Arnold, Fischel, Lonigan, & Valdez-Menchaca, 1991).

Paul's (1996) watch-and-see recommendation was generated in reference to the Portland Language Development Project. These outcome data suggested that children with early delayed expressive language, who came from stable, middle-class homes with no other behavioral, medical, or hearing concerns, should be monitored rather than receive intervention. Both FH+ and FH– control groups in this study consisted of children from just such environments. However, in the present study, it was shown that the pattern of linguistic delays from the early to later years was strongest for children with a positive family history, even given their supposedly optimal middle-class environment and benign behavioral, medical, or hearing history. Of considerable interest is the fact that across age, the same individual children were not always consistently delayed, and the type of weakness changed as a function of age. Such a finding might be an artifact of variation in an individual testing session (e.g., child state, time of day, etc.); however, it is important to note that even in older children diagnosed as LLI, language profiles have been shown to change over the years as a function of maturation, experience, and degree of initial impairment (Conti-Ramsden, Botting, & Faragher, 2001).

These findings emphasize the importance of vigilant monitoring of the speech and language progress of children who are known to be at higher risk for LLI, regardless of their sociodemographic characteristics or previous language assessments. If a child born into a family with a history of LLI is also among those children presenting with lower receptive and/or expressive language at an early age, then these children essentially have two significant risk factors for later disorder. In such cases, early language intervention will be the best approach for limiting the potential impact of language-learning delays.

Parents with an older child diagnosed with LLI are often acutely aware of the possibility that their infants are at higher risk for developing future language and reading problems. Thus, such parents are often interested, from quite early on, in their children's developmental progress and are willing to pursue intervention at the first sign of delayed language. It can also be both motivating and encouraging for a family to know that they have taken appropriate action and are giving their children very early language support. However, in our sample, the number of children receiving preschool intervention was relatively low compared to the number of children who presented with low language scores in receptive and/or expressive language. Although intervention was recommended and appropriate referral sources provided, it is likely that many of the children identified in our study as presenting with low language did not meet the strict eligibility criteria set by early intervention programs and preschool disabled classes in our state.

We recommend that a comprehensive oral language history be a part of any evaluation of a child in kindergarten or first grade who is suspected of having a learning disability related to early reading. Although the initial benchmarks of early reading success may be successful decoding, the long-term goal of reading is successful reading comprehension. Intervention programs that include only intensive phonics may well serve the majority of young children who having difficulties in the early reading process. However, for those children with past and concurrent oral language problems that include vocabulary, morphology, and syntax, a "one size fits all" phonics approach will not work. These children need to have their oral language as well as their written language deficits addressed to assure that the reading process as well as overall educational success is achieved.

Conclusion

In this study, we presented data that support the notion that children born into families with a history of LLI are at much greater risk for developing a related impairment at some point during their preschool and early school years. At every age, the FH+ group significantly differed from their FH– control group across multiple language domains. As a group, their performance consistently lagged behind their matched controls, even though only a subgroup of FH+ children were expected to eventually be clinically diagnosed as LLI. Although our participants were ascertained as infants, based on a family history of LLI rather than on demonstrated delays in early language acquisition, as has been the case in previous research, at every age examined, a subset of children performed in the clinical to subclinical range on at least one of the assessed domains. This highlights the changing profile of LLI, particularly in children who have family members with associated problems. Given the strong behavioral and genetic evidence that suggests a much higher risk for developing language-learning problems across the early years, children with a positive family history for LLI are an essential group to follow closely. Monitoring early language in relation to language outcomes in such high-risk groups is essential to assessing which components of early language may best predict future language competency. Most important, children may gain from early intervention based on prospective selective screening, thus preventing early delays from exerting negative cascading effects on later language, academic, and social skills.

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